

Quick Problems Using Equations in Chapter 10 and 11

Clausius-Clapeyron Equation

If the barometric pressure in Reno, NV (elevation 4500 ft) is 680 torr, at what temperature will water boil?

The melting point of potassium metal is 63.2°C. Molten potassium has a vapor pressure of 10.00 torr at 443°C and a vapor pressure of 400.0 torr at 708°C. Use these data to calculate the heat of vaporization of liquid potassium.

Heating Curves

Calculate the enthalpy change upon converting 50.0 g of ice at -25.0°C to water vapor at 125°C under a constant pressure of 1 atm. The specific heats of ice and steam are $2.09 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$, and $1.84 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$ respectively. For H_2O , $\Delta H_{\text{fus}} = 6.01 \text{ kJ mol}^{-1}$ and $\Delta H_{\text{vap}} = 40.7 \text{ kJ mol}^{-1}$.

Phase Diagrams

The normal melting and boiling points of O_2 are -218°C and -183°C, respectively. Its triple point is at -219°C and 1.14 torr, and its critical point is at -119°C and 49.8 atm. (a) Sketch the phase diagram for O_2 , showing the four points given and indicating the area in which each phase is stable. (b) Will $\text{O}_{2(\text{s})}$ float on $\text{O}_{2(\text{l})}$? Explain. (c) As it is heated, will solid O_2 sublime or melt under a pressure of 1 atm?

Henry's Law

Calculate the concentration of CO_2 in a soft drink that is bottled with a partial pressure of CO_2 of 4.0 atm over the liquid at 25°C . The Henry's law constant for CO_2 in water at this temperature is $3.1 \times 10^{-2} \text{ mol L}^{-1} \text{ atm}^{-1}$. Calculate the concentration of CO_2 in a soft drink after the bottle is opened and equilibrates at 25°C under a partial pressure of $3.0 \times 10^{-4} \text{ atm}$.

Raoult's Law

Glycerin ($\text{C}_3\text{H}_8\text{O}_2$) is a nonvolatile nonelectrolyte with a density of 1.26 g/mL at 25°C . Calculate the vapor pressure at 25°C of a solution made by adding 50.0 mL of glycerin to about 500.0 mL of water. The vapor pressure of pure water at 25°C is 23.8 torr.

Calculate the mass of ethylene glycol ($\text{C}_2\text{H}_6\text{O}_2$) that must be added to 1.00 kg of ethanol ($\text{C}_2\text{H}_5\text{OH}$) to reduce its vapor pressure by 10.0 torr at 35°C . The vapor pressure of pure ethanol at 35°C is $1.00 \times 10^2 \text{ torr}$.

Osmotic Pressure

The average osmotic pressure of blood is 7.7 atm at 25°C . What concentration of glucose in aqueous solution will be isotonic with blood?

What is the osmotic pressure at 20°C of a 0.200 M sucrose solution?

The osmotic pressure of an aqueous solution of a certain protein was measured in order to determine the protein's molar mass. The solution contained 3.50 mg of protein dissolved in water to form 5.00 mL of solution. The osmotic pressure of the solution at 25°C was found to be 1.54 torr. Calculate the molar mass of the protein.